

REMARKS/ARGUMENTS

Claims 1 and 3-7 are pending herein. The amendment to claim 1 is supported by Figure 1 and in the specification at pages 14-16, for example. Applicants respectfully submit that no new matter has been added.

1. Claims 1 and 4 were rejected under §103(a) over Kato in view of Atsumi and Dillon. To the extent that this rejection may be applied against amended claim 1, it is respectfully traversed.

Independent claim 1 recites a gas sensor included a gas sensor element for measuring a predetermined gas component of an introduced measurement gas, and a protective cover that surrounds the sensor element. The protective cover includes an inner protective cover, an intermediate protective cover and an outer protective cover. The inner protective cover has a bottom equipped cylindrical shape with a plurality of gas inlet holes formed in the side surface thereof facing the sensor element. The inner protective cover covers at least an end portion of the sensor element and has at least one inner gas discharge hole formed on the bottom portion. The intermediate protective cover which is installed between the inner and outer protective covers includes intermediate gas inlet holes formed at positions where the intermediate gas inlet holes do not face the inner gas inlet holes. The outer protective cover, which covers the inner protective cover, has a bottom equipped cylindrical shape with a plurality of gas inlet holes formed in the side surface of the outer protective cover at positions where the outer gas inlet holes do not face the inner gas inlet holes. The number of the inner gas inlet holes is greater than the number of the outer gas inlet

holes and the area of each of the inner gas inlet holes is less than the area of each of the outer gas inlet holes. The distance from the outer gas inlet holes to the intermediate gas inlet holes is greater than the distance from the intermediate gas inlet holes to the inner gas inlet holes. Claim 1 has been amended to recite that $A1/A2 > 1$, where $A1$ is the total opening area of the inner gas inlet holes and $A2$ is the total opening area of the outer gas inlet holes.

Kato discloses a gas sensor that includes a gas sensor element for measuring a predetermined gas component and a protective cover surrounding the gas sensor element. The protective cover of Kato includes an inner protective cover, an intermediate protective cover and an outer protective cover. Atsumi discloses a gas sensor with a protective cover including an inner protective cover and an outer protective cover. Dillon discloses an oxygen sensor having a sensor element surrounded by a protective cover of an outer metal shield and an inner perforated sleeve.

The present invention of amended claim 1 is distinguishable from the cited references because none of the references teach or suggest a sensor in which the total opening area of the inner gas inlet holes is greater than the total opening area of the outer gas inlet holes, as claimed. More specifically, Kato discloses a sensor having six inner gas inlet holes having a diameter of 1.4 mm and six outer gas inlet holes having a diameter of 2.5 mm (see column 13, lines 26-41). This results in the outer gas inlet holes having a greater total area than the inner gas inlet holes.

Atsumi discloses that the disclosed gas sensor has an equal number of inner (second) gas inlet holes and outer (first) gas inlet holes, and that the first gas inlet holes and second gas inlet holes have the same total area of 4.9 mm².

In the gas sensor disclosed by Dillon, the perforated inner sleeve of Dillon has a greater number of gas inlet holes than the number of exhaust gas inlet slots in the outer metal sleeve. However, Dillon fails to provide the number of exhaust gas inlet slots, the total area of the exhaust gas inlet slots or the total area of the openings in the perforated inner sleeve.

In contrast, in the first embodiment of the present invention disclosed in the specification, the gas sensor has twelve inner gas inlet holes, each having a diameter of 1.5 mm, and six outer gas inlet holes, each having a diameter of 2.0 mm (see specification at pages 14-16). Using the disclosed values,

$$\begin{aligned}\text{Area inner} &= \pi r^2 = (3.14) (.75)^2 = 1.76625 \text{ mm}^2 \\ A1 &= (12) (1.76625) = 21.195 \text{ mm}^2\end{aligned}$$

$$\begin{aligned}\text{Area outer} &= \pi r^2 = (3.14) (1)^2 = 3.14 \text{ mm}^2 \\ A2 &= (6) (3.14) = 18.84 \text{ mm}^2\end{aligned}$$

The advantage of the claimed sensor configuration, as stated in the specification is that when the area of the inner gas inlet holes is greater than the area of the outer gas inlet holes, a pressure drop is provided that facilitates the diffusion of the measurement gas, thereby avoiding local temperature changes at the sensor which can crack the sensor, and prevents water droplets from impacting the sensor (see pages 14-16 of the specification).

Thus, the references alone or in combination do not teach or suggest a sensor in which the total area of the inner gas inlet holes is greater than the total area of the outer gas inlet holes. Based on the above, the cited references fail to teach or suggest each and every element of amended claim 1. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

2. Claim 3 was rejected under §103(a) over Kato, Atsumi and Dillon, further in view of Toguchi; claim 5 was rejected under §103(a) over Kato, Atsumi and Dillon, further in view of Watanabe; claim 6 was rejected under §103(a) over Kato, Atsumi and Dillon, further in view of Young; and claim 7 was rejected under §103(a) over Kato, Atsumi and Dillon, further in view of Nakamura. These rejections are respectfully traversed, because all of these claims ultimately depend from claim 1, and claim 1 is patentable for the reasons explained above.

For at least the foregoing reasons, Applicants respectfully submit that all pending claims herein define patentable subject matter over the art of record.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

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